1,163,632

PATENT SPECIFICATION 1,163,632

DRAWINGS ATTACHED.

Date of Application (No. 19084/67) and filing Complete Specification: 25 April, 1967.

Application made in Germany (No. S103,416 XII/47b) on 26 April, 1966.

Complete Specification Published: 10 Sept., 1969.

Index at acceptance:—F2 A16.

International Classification:—F 16 c 39/06.

COMPLETE SPECIFICATION.

A Magnetic Bearing for a Shaft.

We, SIEMENS AKTIENGESELLSCHAFT, a German Company, of Berlin and Munich, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a combination of a rotatable shaft and a magnetic bearing for it. The shaft may be vertical and have fixed to it the rotor of an electricity meter.

According to the invention there is provided a combination of a rotatable shaft and a magnetic bearing for it, the bearing comprising first and second magnetic bodies composed at least partly of permanent magnets, one body being fixed and the other being fixed to the shaft, the two bodies being spaced apart by an air gap and at least one of them having near and concentrically surrounding the axis of the shaft, a first surface which faces and bounds the air gap and which lies in a plane to which said axis is perpendicular and a second surface which faces and bounds the air gap and is further from and concentrically surrounds the axis of the shaft and lies in another plane to which said axis is perpendicular, the second surface being set back behind the first surface, considered from the air gap, the arrangement being such that the part of the air gap bounded by said second surface is wider that the part bounded by said first surface.

Two examples in accordance with the invention are described below with reference to Figures 1 and 2, respectively, of the accompanying drawing, each of which diagrammatically shows, partly in section, a combination of a rotatable shaft and a magnetic bearing for it.

In each example the shaft is vertical and is referenced 4.

[Pri

In the first example the bearing comprises first and second magnetic bodies 1 and 2 composed at least partly of permanent magnets, the body 2 being fixed and the body 1 being fixed to the shaft. The two bodies have polarities as shown, so that they repel one another, and are spaced apart by an air gap. Each of them has, near and concentrically surrounding the axis of the shaft, a first surface which faces and bounds tthe air gap and which lies in a plane to which that axis is perpendicular (i.e. a horizontal plane) and a second surface which faces and bounds the air gap and is further from and concentrically surrounds the axis of the shaft and lies in another plane to which that axis is perpendicular (i.e. another horizontal plane), the second surface being set back behind the first surface, considered from the air gap. In the case of the body 1 the first and second surfaces are 1A and 1B, respectively, and in the case of the body 2 they are 2A and 2B, respectively. In each case an annular channel 1C or 2C, with side walls perpendicular to its base and to the surfaces 1A and 1B or 2A and 2B, separates the first and second surfaces.

If desired, only one of the bodies could have the first and second surfaces in two horizontal planes and one set back behind the other, provided that, as in the example according to Figure 1, the part of the air-gap bounded by the second surface is wider than the part of it bounded by the first surface.

In the example according to Figure 2, the bearing comprises the bodies 1 and 2 with the surfaces 1A and 1B and 2A and 2B, respectively, as before, but here each of the bodies consists of a cylindrical permanent magnet 11 and a cup-shaped housing of soft magnetic material, i.e. soft iron, the magnet

being coaxially disposed within the housing and the end of the magnet which is further from the air gap being in contact with the base of the housing, the surfaces 1A and 1B or 2A and 2B being at the other end of the magnet and at the rim of the housing, respectively. Again the bodies 1 and 2 repel one another and each of them is formed with an annular channel which is in accordance with the description given above of the channels 1C and 2C of Figure 1. The fixed housing 12 is provided with a hole 6 to receive a screw or other device for fixing it. The magnetic bodies may, if desired, be assembled from individual sections, for example each of sector form or concentric with one another.

The example according to Figure 2 could be modified by only one of the two bodies having the first and second surfaces in two horizontal planes and one set back behind the other, provided that, as in the example according to Figure 2, the part of the air gap bounded by the second surface is wider than the part of it bounded by the first surface.

In each case there is a journal bearing 5 for the shaft above the magnetic bearing and the shaft "floats" because there is no contact between the bodies 1 and 2.

WHAT WE CLAIM IS:—

1. A combination of a rotatable shaft and a magnetic bearing for it, the bearing comprising first and second magnetic bodies composed at least partly of permanent magnets, one body being fixed and the other being fixed to the shaft, the two bodies being spaced apart by an air gap and at least one of them having, near and concentrically surrounding the axis of the shaft, a first surfaces and bounds the air gap and is further which lies in a plane to which said axis is perpendicular and a second surface which faces and bounds the air gap and is further from and concentrically surrounds the axis of the shaft and lies in another plane to which said axis is perpendicular, the second surface being set back behind the first surface, considered from the air gap, the arrangement being such that the part of the air gap bounded by said second surface is wider than the part bounded by said first surface.

2. A combination according to claim 1 in which at least one of the bodies consists of a cylindrical permanent magnet coaxial with the shaft and co-axially disposed within a cup-shaped housing of soft magnetic material, with the end of the magnet which is further from the air gap being in contact with the base of the cup-shaped housing, said first and second surfaces being at the other end of the magnet and at the rim of the cup-shaped housing, respectively.

3. A combination of a rotatable shaft and a magnetic bearing for it, substantially as described above with reference to Figure 1 or Figure 2 of the accompanying drawings.

4. An electricity meter in which the rotor has fixed to it the shaft of a combination according to any preceeding claim.

HASELTINE, LAKE & CO.,
Chartered Patent Agents,
28, Southampton Buildings,
Chancery Lane,
London, W.C.2.
Agents for the Applicants.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1969.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.

1163632 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

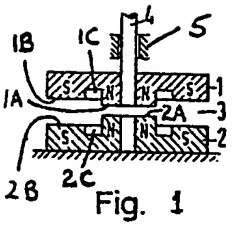

Fig. 1

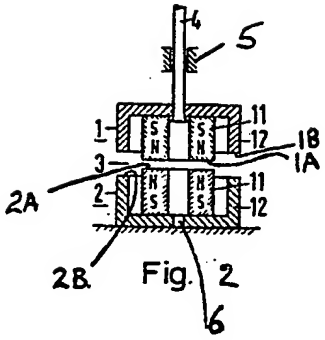

Fig. 2